I. BACKGROUND

Syphilis is a sexually transmitted disease (STD) caused by *Treponema pallidum* bacteria. The disease occurs in four stages: primary, secondary, latent (early and late), and tertiary. If *Treponema pallidum* passes across the placenta during any stage of syphilis, congenital syphilis results. Acute syphilis is a genital ulcerative disease while chronic syphilis could involve the heart and central nervous system. It causes reproductive health problems, pregnancy-related problems, and neurologic problems. It also facilitates the transmission of HIV infection. However, antibiotic therapy has been shown to be highly effective in eliminating *Treponema pallidum.* Early detection of syphilis with appropriate treatment could eradicate the infection, thereby preventing both the disabling progression of the disease and its transmission to sexual contacts (1, 2, 3, 4).

In the 1940s, syphilis was spread widely throughout the United States. It declined rapidly after the introduction of penicillin therapy and broad-based public health programs. After sustaining a steady incidence rate during the 1970s and the early 1980s, the rate of syphilis increased sharply from 1987 through 1990 in the United States. In 1991, syphilis rates began to decline and have declined each year since that time with the incidence of primary and secondary syphilis 3.2 per 100,000 persons in 1997 in the United States (5, 6).

Nashville and Davidson County's syphilis trend, however, differs considerably from the national trend, according to syphilis surveillance data. Specifically, in 1996, the incidence rate was 36.4 cases per 100,000 persons, a 99% increase compared to 1995. This increase reversed a five-year trend of declining syphilis incidence in Nashville and Davidson County, Tennessee. (In the rest of the report, we will refer to " Nashville and Davidson County, Tennessee" as "Nashville.") The increase continued in 1997 with a rate of 38.2 cases per 100,000 persons, approximately 12 times as high as the nation's (3 times as high as Tennessee's) primary and secondary syphilis rate of that year. With roughly 10% of the Tennessee population, Nashville had 27% of the state's reported P & S syphilis cases in 1997. The 1996-1997 increase is in contrast to the nation's and state's declining syphilis trends. Therefore, even though the current epidemic does not reach Nashville's P & S syphilis peak rate of 1990, Nashville's relative ranking of P & S syphilis rate among 64 cities of more than 200,000 population in the United States raised substantially. In 1990, Nashville was ranked as a city with eleventh highest P & S syphilis rate, in 1996, fifth highest, and in 1997, third highest (6-16) (Figure 1).

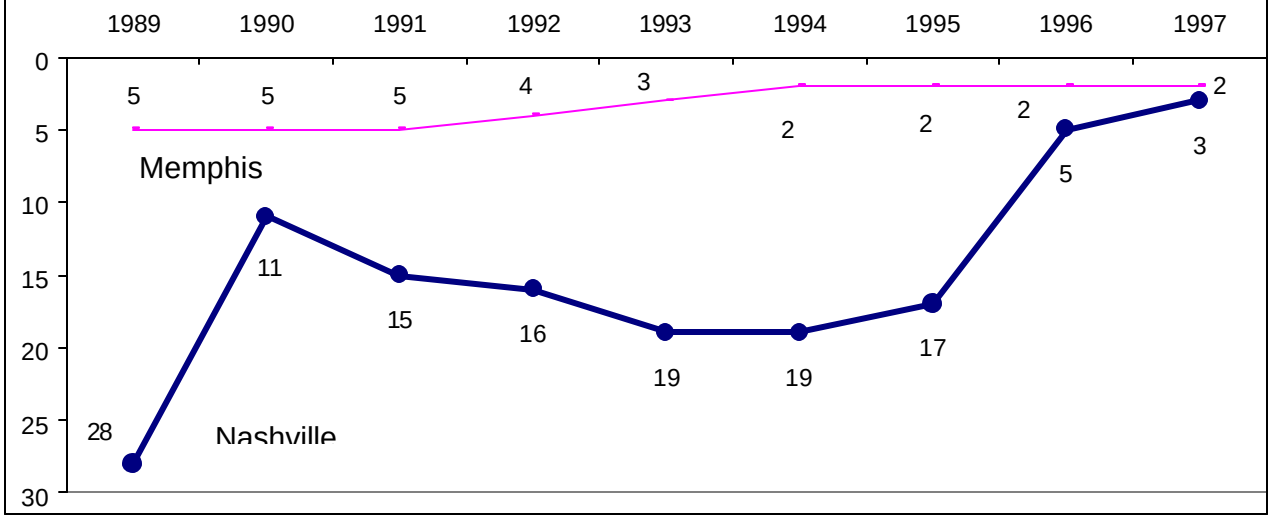
To better understand the current syphilis epidemic[1], an investigation was conducted. The purpose of the investigation was threefold: 1) describe past and current trends of syphilis in Nashville; 2) provide the epidemiology of the current syphilis epidemic in Nashville; and 3) identify high-risk groups and risk factors associated with the current syphilis epidemic for the prevention and control of syphilis in Nashville.

The investigation consisted of two steps. Step one attempted to describe the epidemiology of syphilis. Step two tried to identify risk factors associated with the current syphilis epidemic in Nashville. This paper was the result of step one of the investigation and is part one of a two-part investigative report. It documents the epidemiology of reported

[1] Epidemic is defined as the occurrence in a community or region of cases of an illness, specific health-related behavior, or other health-related events clearly in excess of normal expectancy (17).

primary and secondary syphilis cases in Nashville between 1975 and 1997. It examines long-term and current trends of syphilis and presents a profile of the current syphilis epidemic.

Figure 1. P & S Syphilis: Ranking of Nashville and Memphis among 64 Cities with More Than 200,000 Population, 1989-1997



II. METHODS

1. Data Sources

Two data sources were identified for step one of the investigation.

a. Syphilis surveillance data (1988-1997) were from Tennessee Department of Health (TDH). In Tennessee, all hospitals, physicians, laboratories, and other persons knowing of or suspecting a case are required to report all cases of syphilis to public health authorities (18). Laboratories are required to report any test results that are positive for, or suggestive of, syphilis, regardless of any previous reports that may have been submitted on the same person. All reports collected by local health departments are electronically transmitted to the Tennessee Department of Health.

b. Historical data were from the Sexually Transmitted Disease Surveillance Reports published by the Centers for Disease Control and Prevention (CDC). Consistently compiled national data were available dating back to 1941 (7). For this investigation, Nashville syphilis data for the period between 1975 and 1997 were obtained.

2. Analysis

Data on reported cases of syphilis in the primary and secondary (P & S)[2] stages were used for this investigation because those cases best represent incidence cases of syphilis, i.e., newly acquired infections within the evaluated time period (19). Incidence rates of P & S syphilis per 100,000 persons were calculated. For the past and the current trend descriptions, the incidence rates were directly taken from the CDC's Sexually Transmitted Disease Surveillance Reports. For current syphilis epidemic analysis, rates by age, race, gender, time of diagnosis, planning district, and census tract were calculated using population denominators from TDH's population projection. Population denominator for planning districts was adjusted based on TDH's population projection. The Tennessee Department of Health STD Population Based Report was used to verify the accuracy of the data analysis.

For purposes of analysis, the years 1975 to 1997 were defined as the period for long-term trend analysis, 1988 to 1997 as the period for the current trend analysis, 1994 to 1995 as pre-epidemic period, and 1996 to 1997 as the current epidemic period. With stratification analysis, the total number of a specific age, gender, or race subgroup is sometimes small. Rates based on small numbers will exhibit a large amount of random variation. Therefore, they should be interpreted with caution.

Geographic analyses were performed by planning districts and census tracts using Map-Info version 4.0 software.

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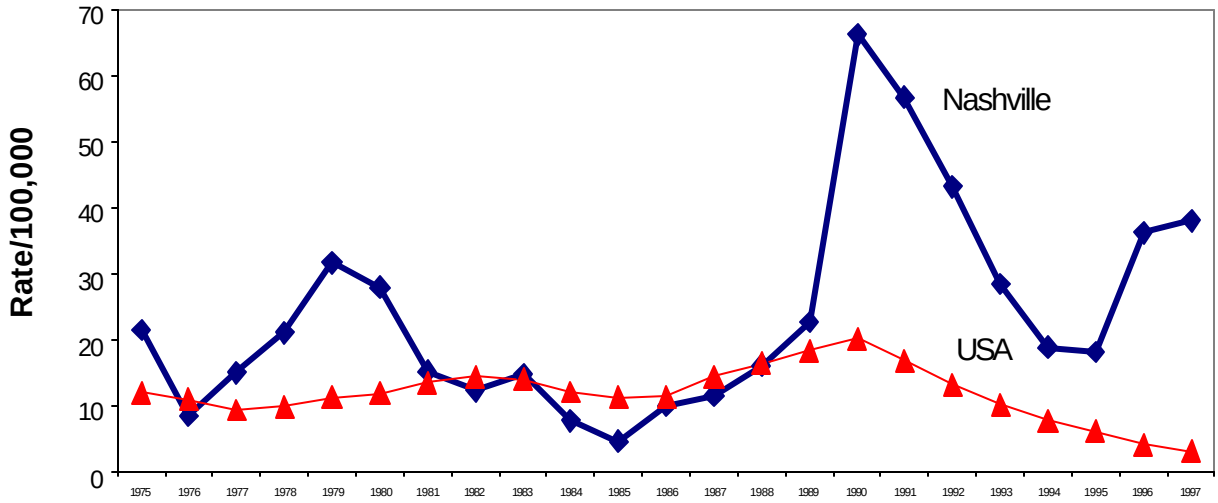
[2] A primary syphilis case is defined as a patient with either 1) a lesion present at the time of examination and typical spirochetes seen on dark-field microscopy of lesion exudate or 2) a lesion present and the fluorescent treponemal antibody absorption (FTA-ABS) serologic test for syphilis reactive. A secondary syphilis case is defined as a patient with the clinical signs (i.e., rash, condyloma lata, generalized lymphadenopathy) noted at the time of presentation and reactive syphilis serologic tests (rapid plasma reagin [RPR]) and FTA-ABS tests.

III. RESULTS

1. Long-Term Trends of Syphilis in Nashville, Tennessee

During the twenty-two year period from 1975 to 1997, primary and secondary syphilis incidence[3] in Nashville fluctuated greatly (Figure 2). In 1975, the incidence of P & S syphilis was 21.6 cases per 100, 000 persons (98 cases). In 1976, the rate declined to 8.6 cases per 100,000 persons. A large increase of P & S syphilis in 1979 (31.8 cases per 100,000 persons) and a remarkable decrease in 1985 (4.7 cases per 100,000 persons) were followed by an increasing trend in P & S syphilis since 1986. This trend reached its peak in 1990 with 66.4 cases per 100,000 persons. The rates then began to fall during the 1991 to 1995 period. Since 1996, the declining trend reversed again with 36.4 cases per 100,000 persons in 1996 and 38.2 cases per 100,000 persons in 1997.

Figure 2. Primary and Secondary Syphilis Rates, Nashville and USA, 1975-1997



Overall, reported syphilis numbers were lower during the 1980s than during the 1990s. The average number of reported cases was 70.6 cases per year (average annual incidence was 14.4 cases per 100,000 persons) during the 1980s, while the number was 199.4 cases per year (average annual incidence was 38.4 cases per 100,000) for eight years during the 1990s, a 182 % increase in the number of cases (167% increase in rate). Put into national perspective, in six out of ten years from 1980 to 1989, Nashville's syphilis rates were below the national rates. However, all eight years in the 1990s had higher rates than national rates. From 1990 to 1995, Nashville's rates were approximately three times as high as the national rates. During the current syphilis epidemic in Nashville, P & S syphilis rates were approximately 8 times (1996) and 12 times (1997) as high as the national rates in the same

[3] Incidence is the rate at which new events occur in a population. In this report, the rate and incidence are used interchangeably (17).

years. A similar pattern was observed when comparing Nashville's rates with Tennessee's rates (Figure 3). In seven out of ten years during the 1980s, Nashville's P & S syphilis rates were below the state's rates, whereas, in seven out of eight years during the 1990s, Nashville had higher rates than the state's rates.

Figure 3. Primary and Secondary Syphilis Rates, Nashville and Tennessee, 1975-1997

2. Current Trends of Syphilis in Nashville, Tennessee

With an unusual syphilis incidence trend in Nashville, the 1990s deserve a close examination. Since the 1990s trend began in the late 1980s, we include 1988 and 1989 data, when it is available, for this current trend analysis.

There were 1,795 P & S syphilis cases reported during 1988-1997. Males comprised 55% of reported cases and females comprised 45% of reported cases during this ten-year period. Whites accounted for 13% of reported cases, blacks for 87%.

During this ten-year period, the annual number of reported P & S syphilis cases in Nashville increased 145% from 83 cases in 1988 to 203 cases in 1997, with peak of 339 reported cases in 1990. The average annual number of cases was 180. P & S syphilis incidence increased 136%, from 16.2 cases per 100,000 persons in 1988 to 38.2 cases per 100,000 persons in 1997. The average annual incidence was 34.6 cases per 100,000 persons (Tables 1, 2).

Table 1. Number of Reported P & S Syphilis Cases by Gender and Race, Nashville, TN, 1988-1997

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total	%
Total	83	117	339	290	224	149	100	97	193*	203	1795	
Male	46	73	216	151	104	85	51	54	96	106	982	55
Female	37	44	123	139	120	64	49	43	97	97	813	45
White	11	11	53	26	40	21	17	16	14	23	232	13
White Male	5	6	36	11	19	13	6	8	10	11	125	7
White Female	6	5	17	15	21	8	11	8	4	12	107	6
Black	72	106	286	264	183	127	83	79	178	180	1558	87
Black Male	41	67	180	140	84	71	45	45	85	95	853	48
Black Female	31	39	106	124	99	56	38	34	93	85	705	39

*1996 reported cases included one other race male.

Table 2. Incidence Rates of Reported P & S Syphilis per 100,000 Persons by Gender and Race, Nashville, TN, 1988-1997

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Total	16.2	22.8	66.4	56.8	43.3	28.6	19.0	18.3	36.4	38.2*
Male	18.9	30.1	89.1	61.9	42.4	34.5	20.6	21.7	38.4	42.1
Female	13.8	16.4	45.8	51.5	44.2	23.4	17.8	15.5	34.8	34.6
White	2.9	2.9	13.9	6.8	10.4	5.5	4.4	4.1	3.6	5.9
White Male	2.7	3.3	19.7	6.0	10.4	7.1	3.3	4.3	5.4	5.9
White Female	3.0	2.5	8.5	7.5	10.5	4.0	5.5	4.0	2.0	5.9
Black	60.4	88.9	239.8	217.8	148.6	101.5	65.4	61.3	136.0	135.6
Black Male	74.6	121.9	327.6	251.1	148.5	123.7	77.3	76.2	142.0	156.6
Black Female	48.2	60.6	164.8	189.5	148.7	82.8	55.2	48.6	131.0	117.8

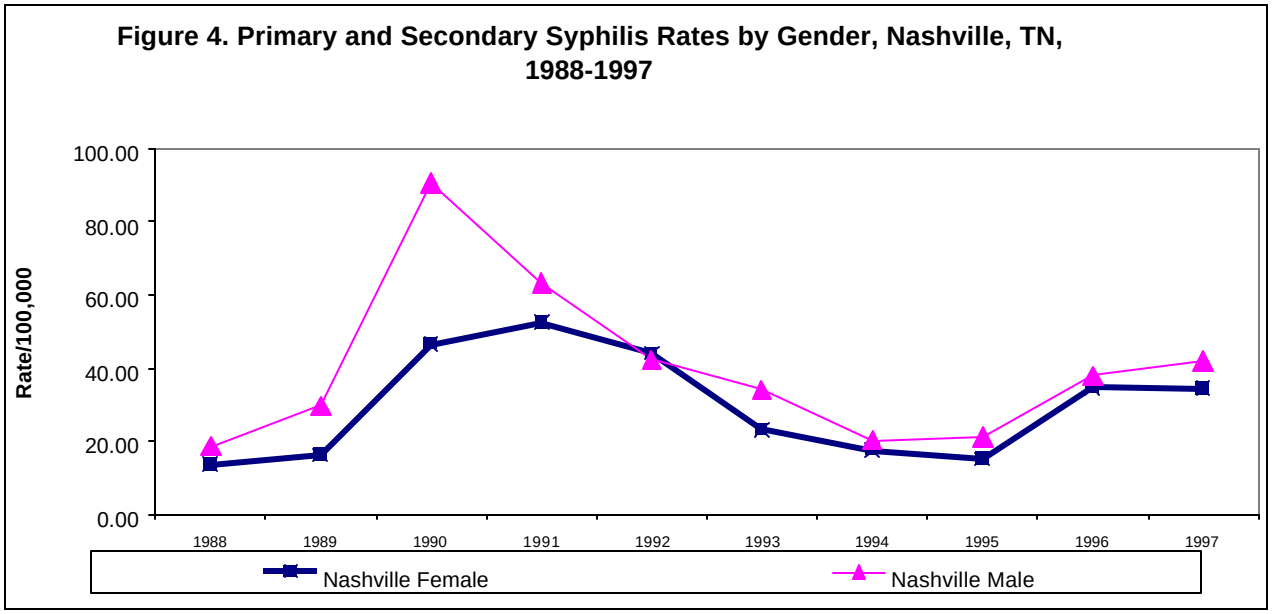
Note: 1. 1988-1989 incidence rates were calculated using 1990 census population.
2. 1991-1997 incidence rates were calculated using TDH population projection based on 1990 census population.
* This number is slightly different from CDC's number (37.9) because different population denominators were used.

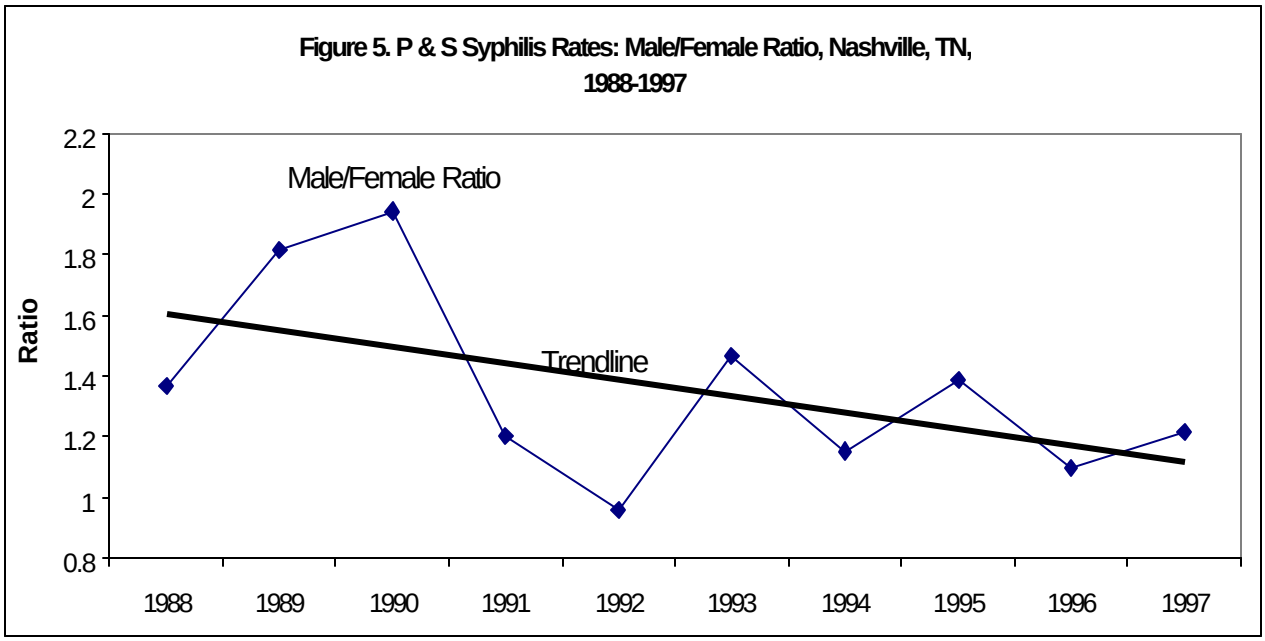
Demographically, trends in P & S syphilis rates varied by gender, race, and age groups.

a. Gender

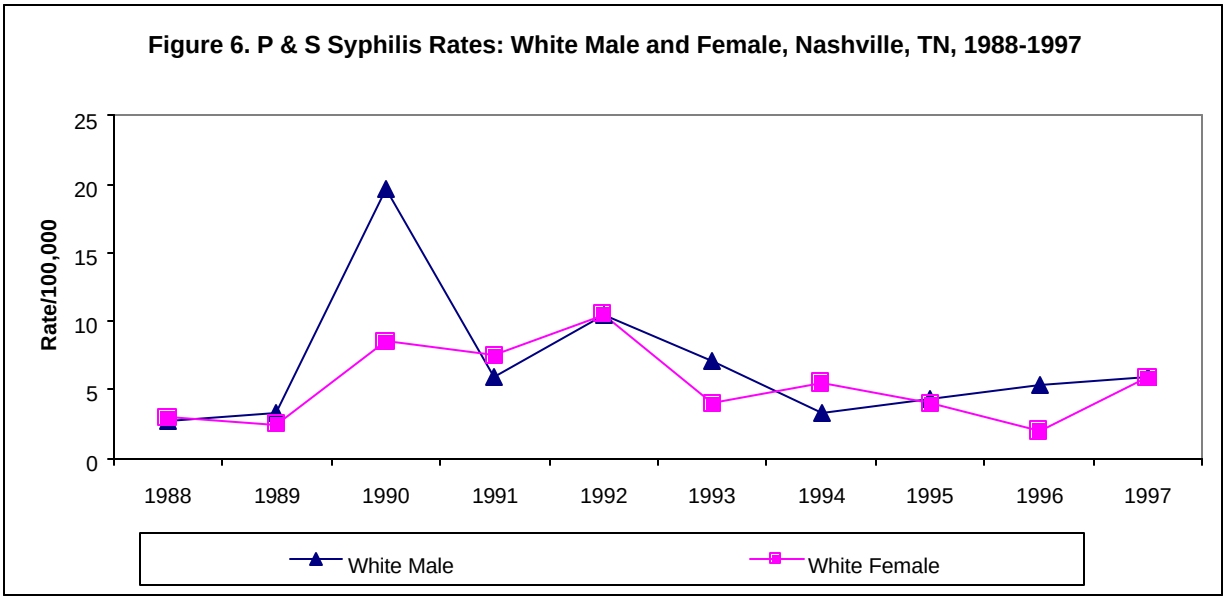
Incidence rates in males were consistently higher than rates in females although the gender gap had been narrowing during this ten-year period (Figure 4).

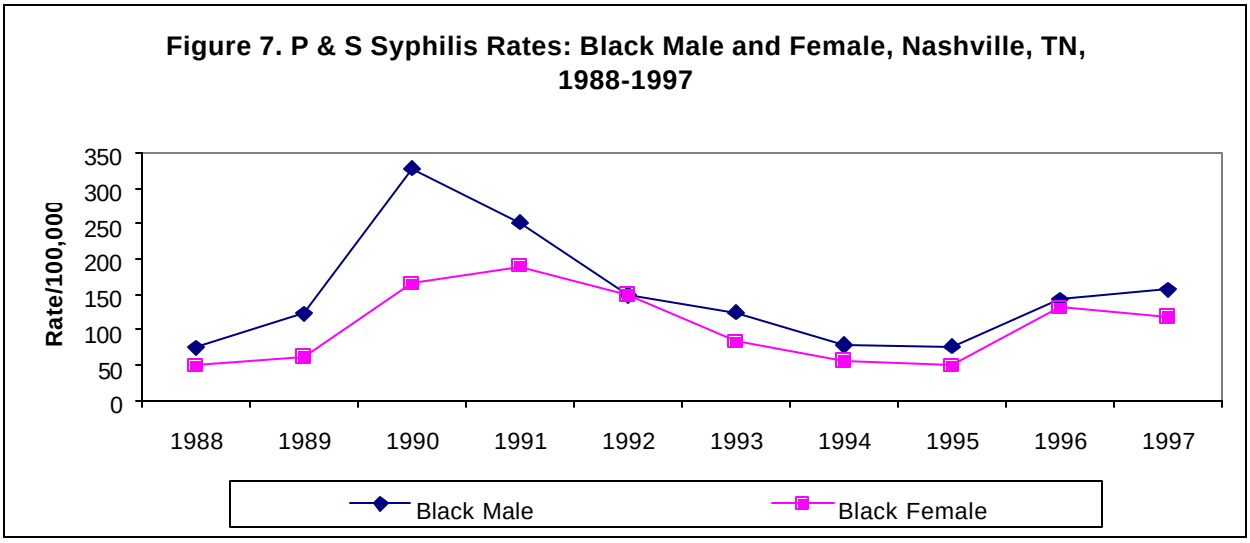
Average male-to-female ratio of P & S syphilis rates during this ten-year period was 1.37. The gender gap was narrower in the current epidemic than in the 1990 epidemic. Male-to-female ratio was 1.95 in 1990 and 1.22 in 1997. The difference in incidence rates between males and females was 43.3 cases/per 100,000 persons in 1990 and 7.5 in 1997. The shrinking of the gender gap suggested an increase in the female proportion of reported cases in the current epidemic. A declining trend of male-to-female ratio was observed for the period, from 1.37 in 1988 to 1.22 in 1997, an 11.2% decrease (Figure 5).





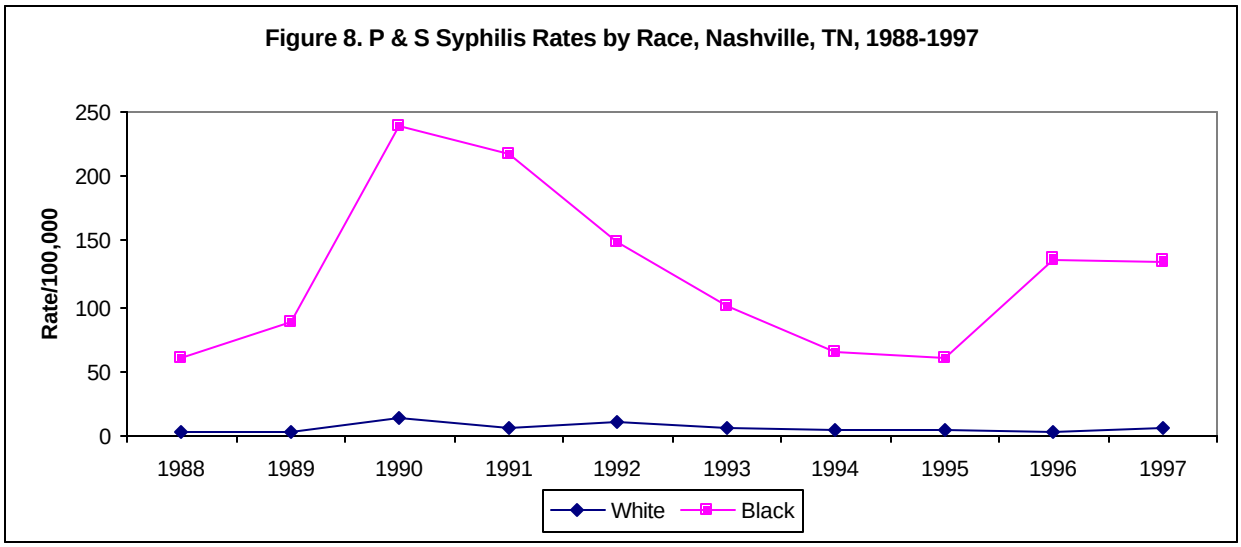
When examining male-to-female ratio by race, the observation that syphilis affected males disproportionately more than females is still valid regardless of race. However, this phenomenon is more apparent in the black population. Among whites, the average male-to-female ratio was 1.35. Among blacks, the average male-to-female ratio was 1.47 (Figures 6,7).



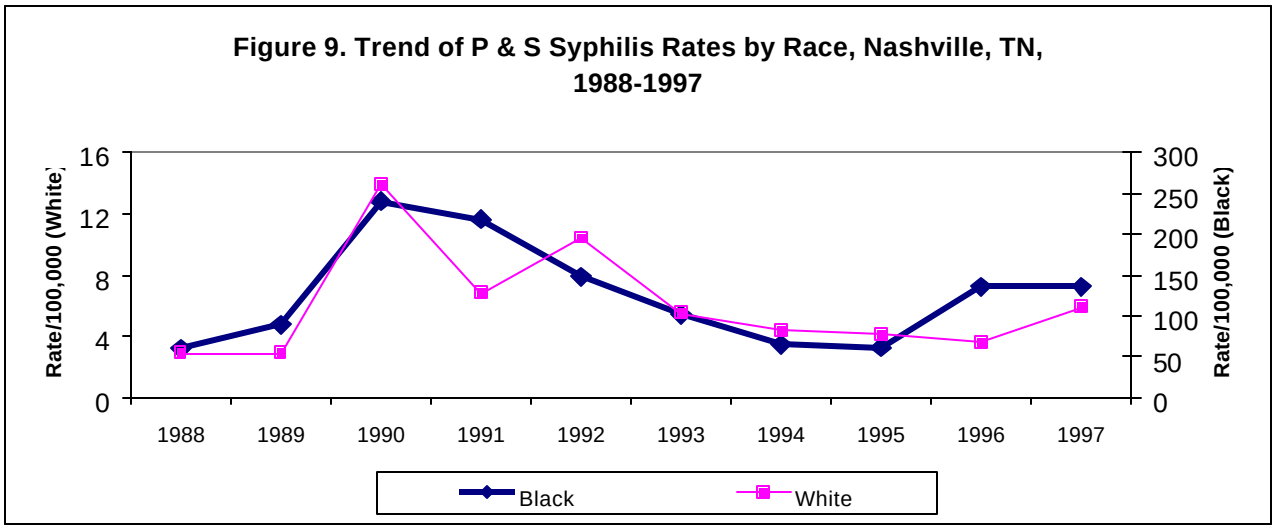


b. Race

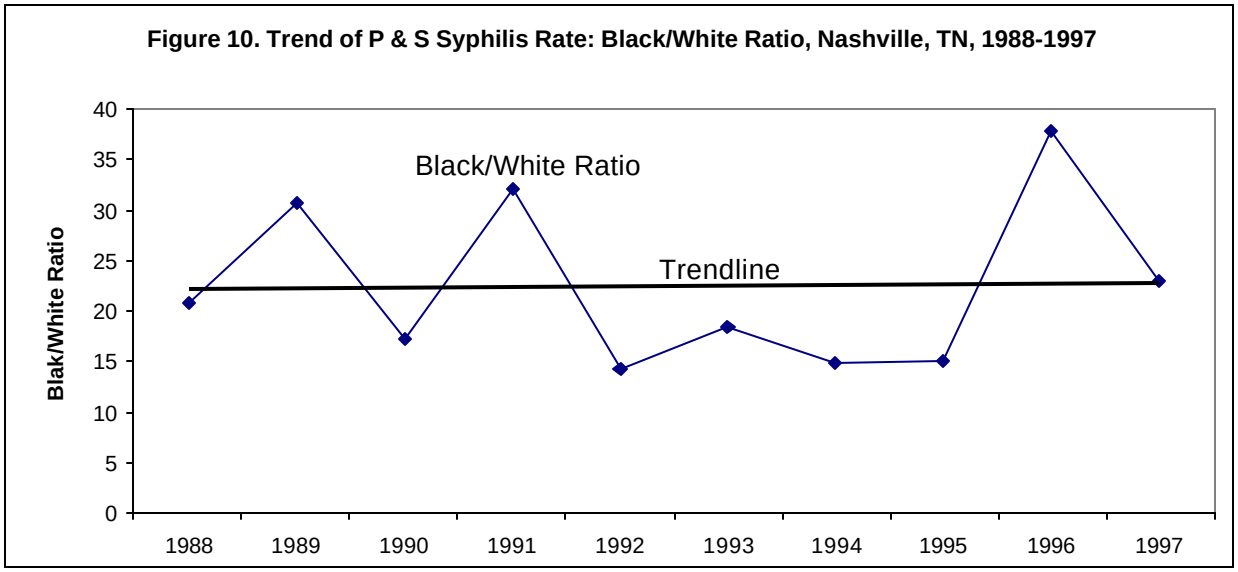
Blacks were disproportionately affected by syphilis during this ten-year period. The total number of reported P & S syphilis cases was 1,558 (87%) in blacks and 232 (13%) in whites. Incidence rates in blacks were consistently higher than rates in whites. The difference in incidence rates between blacks and whites was larger during epidemic periods (differences in rates between blacks and whites was 225.9 cases per 100,000 persons in 1990 and 132.4 in 1996), indicating a substantial racial gap between whites and blacks (Figure 8).



Examining Figure 8, there seems to be greater variations of rate among blacks than whites. However, when adjusting for scale, Figure 9 shows a similar trend in both races.



Alarmingly, an increasing trend of racial gap was observed for this ten-year period, from a black-to-white rate ratio of 20.83 in 1988 to 22.98 in 1997, a 10.4% increase (Figure 10). The average black-to-white ratio of syphilis rates during this ten-year period was 22.4, i.e., syphilis incidence rate in blacks was 22.4 times as high as in whites. When examining black-to-white rate ratio by gender, the racial gap was more apparent in males than in females. Among males, the black-to-white ratio of syphilis incidence was 24.9, while among females, the ratio was 22.8.



c. Age

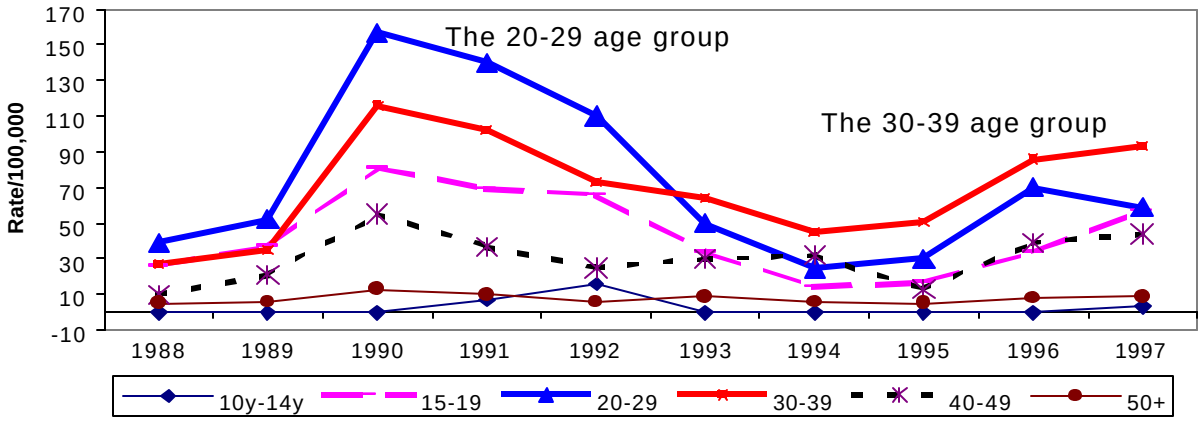
Table 3 summarizes the age characteristics of reported P & S syphilis cases in terms of mean age (average), median age, mode (most frequently occurred age), maximum and minimum age, and age difference between oldest and youngest cases.

Table 3. Age Characteristics of Reported P & S Syphilis Cases, Nashville, TN., 1988-1997

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Mean Age	30	31	31	30	29	33	35	33	33	33
Median Age	28	29	29	29	28	32	34	34	33	32
Mode	28	22	28	20	22	24	35	37	33	32
Minimum Age	16	15	15	13	12	15	16	16	15	14
Maximum Age	61	64	71	69	69	65	64	60	72	74
Age Difference between Oldest and Youngest	45	49	56	56	57	50	48	44	57	60

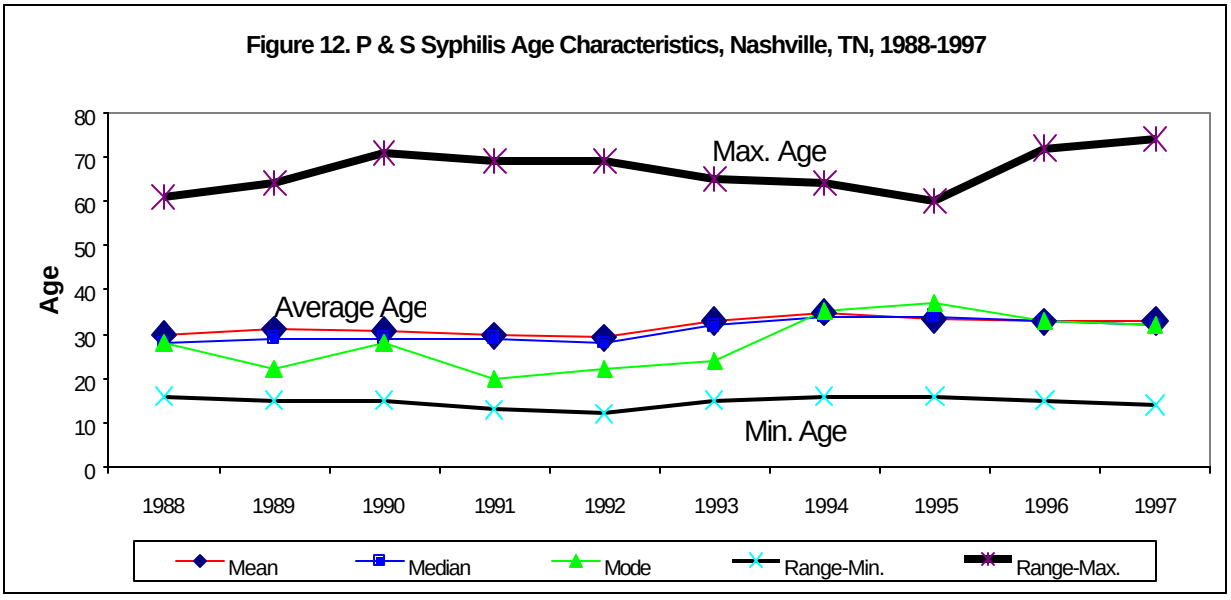
A trend of increasing average age for reported cases was observed from Table 3. It seems that this ten-year period can be divided into two five-year periods. In the first five years (1988-1992), the average age of reported cases was 30 years while in the second five years (1993-1997), the average age increased to 33 years, indicating a change of age pattern in reported cases. This was consistent with a shift in the age groups with highest incidence rate. During the first five years, the 20-29 age group had the highest incidence among all age groups. Since 1993, the 30-39 age group exceeded the 20-29 age group (Figure 11).

Figure 11. Age Distribution of P & S Syphilis Rates, Nashville, TN, 1988-1997



During this ten-year period, the 20-29 age group had 685 reported syphilis cases with an average annual incidence rate of 73 per 100,000 persons. The next highest was the 30-39 age group, with 639 reported cases and an average annual incidence rate of 69 cases per 100,000 persons. The third highest was the 15-19 age group with 152 cases and an annual average incidence rate of 44 cases per 100,000 population.

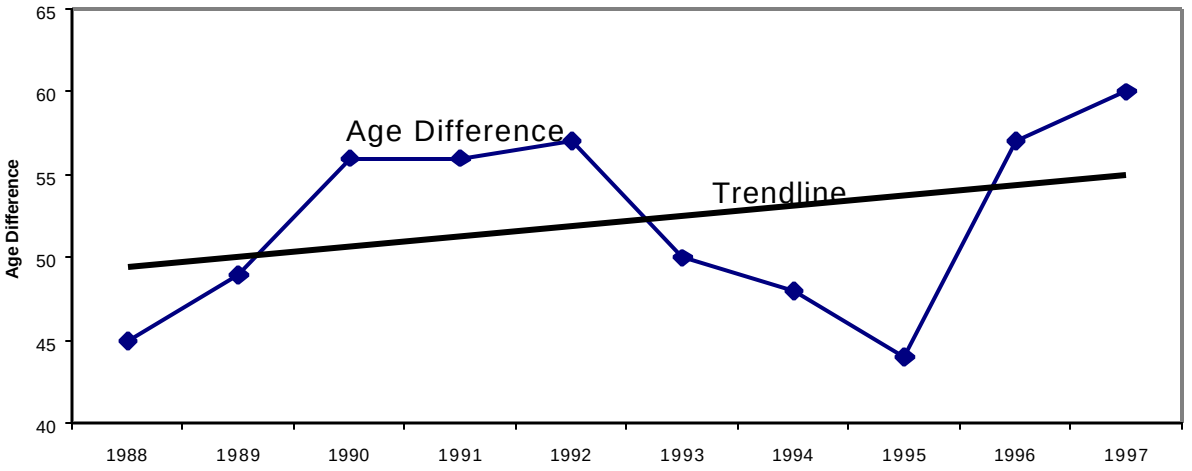
Figure 12. P & S Syphilis Age Characteristics, Nashville, TN, 1988-1997



Figures 12 and 13 show that not only the average age of reported cases was older than before, but that the age range was wider also. In 1988, the age difference between youngest and oldest cases was 45 years. In 1997, the age difference was 60 years. This may suggest a sexual behavior pattern change. Reported cases may have started sexual

activities earlier and stayed sexually active longer than the previous five years. In 1997, the youngest case was 14 years old and the oldest case was 74 years old.

Figure 13. Age Difference Between Oldest and Youngest Cases, P & S Syphilis, Nashville, TN, 1988-1997



The trend of P & S syphilis incidence among age groups was consistent with the above observation. Although the 40-49 age group had the fourth highest average annual incidence rate, this age group had an incidence rate increase of 340%, from 10 cases per 100,000 persons in 1988 to 44 cases per 100,000 persons in 1997. Following the 40-49 age group was the 30-39 age group, with a 244% increase (Table 4).

Table 4. P & S Syphilis Number and Rates per 100,000 Persons by Age Group, Nashville, TN, 1988-1997

	10-14*		15-19		20-29		30-39		40-49		50+	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
1988	0	0	9	26	39	39	25	27	6	10	5	5
1989	0	0	13	37	50	52	33	35	13	21	8	6
1990	0	0	28	81	151	157	109	116	35	55	16	13
1991	2	7	24	69	133	140	95	102	24	37	12	10
1992	5	16	23	66	103	110	68	73	17	25	8	6
1993	0	0	12	34	46	50	59	64	21	30	11	9
1994	0	0	5	14	23	25	41	45	23	32	8	6
1995	0	0	6	17	27	30	47	51	10	13	7	5
1996	0	0	12	34	62	70	78	86	30	39	11	8
1997	1	3	20	57	51	59	84	93	35	44	12	9
Average Annual Rate		3		44		73		69		31		8
% Increase of rate from 1988 to 1997		Infinite		119		51		244		340		80

* 10-14 =10 years old to 14 years old, 15-19 = 15 years old to 19 years old, and so on.

3. Epidemiologic Profile of the Current Syphilis Epidemic in Nashville

As mentioned before, the incidence rate of reported P & S syphilis cases increased 99% from 1995 to 1996 and this increase continued in 1997. There is no doubt that Nashville experienced a syphilis epidemic in 1996 and 1997.

The following section describes the epidemiology of the 1996-1997 syphilis epidemic in Nashville, using reported P & S syphilis data. Since the number of the reported cases in 1994 was at the same level as that in 1995, reported syphilis data in 1994 and 1995 were used as baseline data to help understand the epidemiologic changes during this epidemic period.

a. Race and Gender Distribution

There were 396 reported P & S syphilis cases in 1996 and 1997 (193 in 1996 and 203 in 1997). Males account for 51.0% of cases and females for 49.0% of cases. Blacks comprised 90.4% of cases and whites, 9.3% of cases (Table 5). The average age of reported cases was 33 years in 1996 and 1997. The age of the most frequently reported cases was 33 in 1996 and 32 in 1997. The youngest case was 14 years old and the oldest case was 74 years old during this two-year period.

Table 5. Number and Incidence Rates Per 100,000 of Reported Cases of P & S Syphilis by Gender and Race, Nashville, TN, 1996-1997

	1996 (Total Number: 193)				1997 (Total Number: 203)				Total (1996-1997)	
	Male*		Female		Male		Female			
	#	Rate	#	Rate	#	Rate	#	Rate	#	%
Total	*96*	38.4	*97*	34.8	*106*	42.1	*97*	34.6	*396*	100
White	*10*	5.4	*4*	2.0	*11*	5.9	*12*	5.9	*37*	9.3
Black	*85*	142.0	*93*	131.0	*95*	156.6	*85*	117.8	*358*	90.4

* 1996 male cases included one other race.

b. Age Distribution

Examining age distribution, it was found that the 30-39 age group accounts for 41% of total cases, followed by the 20-29 age group with 29% of cases in the 1996-1997 period. Together, these two age groups account for 69% of reported cases. In other words, more than two in every three cases were between ages 20-39, some of the most productive years of human life. Looking at the incidence, the 30-39 age group had the highest rate (average annual rate[4]: 89.5 cases per 100,000 persons) among all age groups, seconded by the 20-29 age group (average annual rate: 64.5 cases per 100,000 persons) (Table 6).

[4] Average annual rate is calculated by (1996 rate + 1997 rate)/2

Table 6. Number and Incidence Rate per 100,000 of P & S Syphilis by Gender and Age, Nashville, TN, 1996-1997

	1996						1997					
	Male		Female		Total		Male		Female		Total	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
0-14	*0*	0	*0*	0	*0*	0	*0*	0	*1*	6	*1*	3
15-19	*6*	34	*6*	35	*12*	34	*3*	17	*17*	98	*20*	57
20-29	*25*	59	*37*	82	*62*	70	*24*	57	*27*	61	*51*	59
30-39	*38*	86	*40*	86	*78*	86	*42*	96	*42*	91	*84*	93
40-49	*16*	43	*14*	35	*30*	39	*27*	71	*8*	19	*35*	44
50+	*11*	20	*0*	0	*11*	8	*10*	18	*2*	3	*12*	9
All	*96*	38	*97*	35	*193*	37	*106*	42	*97*	35	*203*	38

When the age distribution was further checked by gender, it was observed that the age distribution changed remarkably from 1996 to 1997. First, incidence rates of both genders in the 30-39 age group continued to increase, whereas incidence rates of both genders in the 20-29 age group decreased from 1996 to 1997. Second, incidence rate in the female 15-19 age group increased 180%, from 35 cases per 100,000 persons in 1996 to 98 cases per 100,000 persons. This increase made the female 15-19 age group the sub-group with the highest incidence rate in 1997. Third, the incidence rate in the male 40-49 age group increased 65%, from 43 cases per 100,000 persons in 1996 to 71 cases per 100,000 persons in 1997 (Figures 14a, 14b).

Figure 14a. Age Distribution of P & S Syphilis Rate by Gender, Nashville, TN, 1996

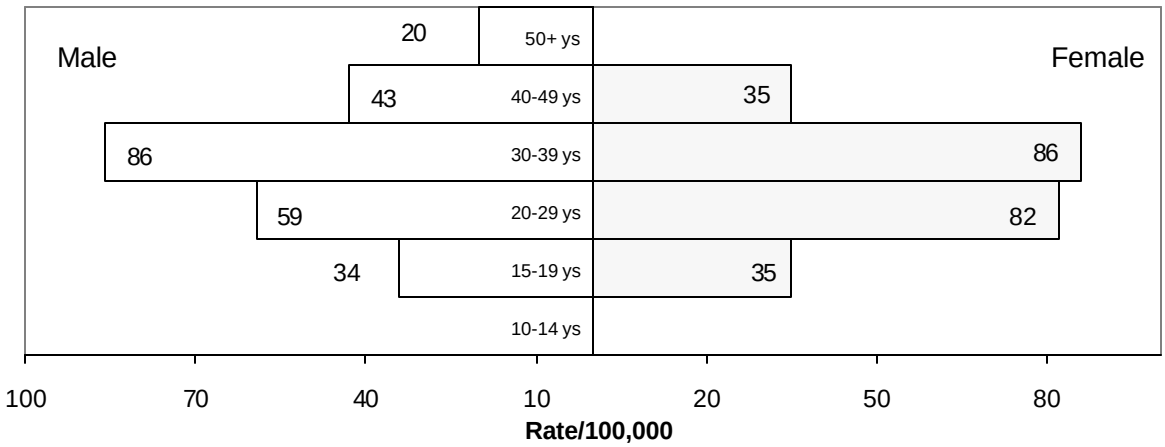
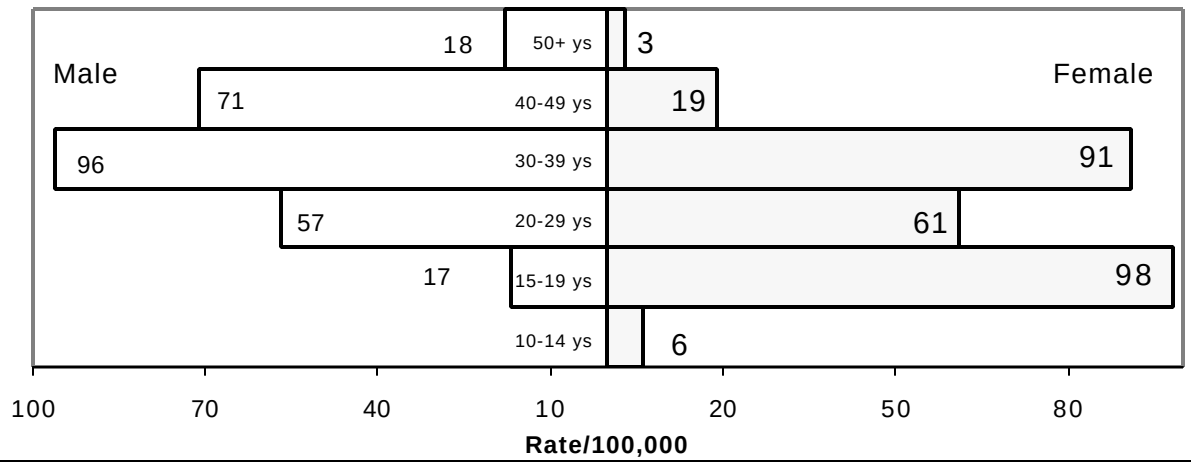


Figure 14b. Age Distribution of P & S Syphilis Rate by Gender, Nashville, TN, 1997



Examination of the female 15-19 age group and the male 40-49 age group by race revealed that the increase occurred in both races. Due to the small numbers in the subgroups, however, caution should be used when interpreting these data (Table 7).

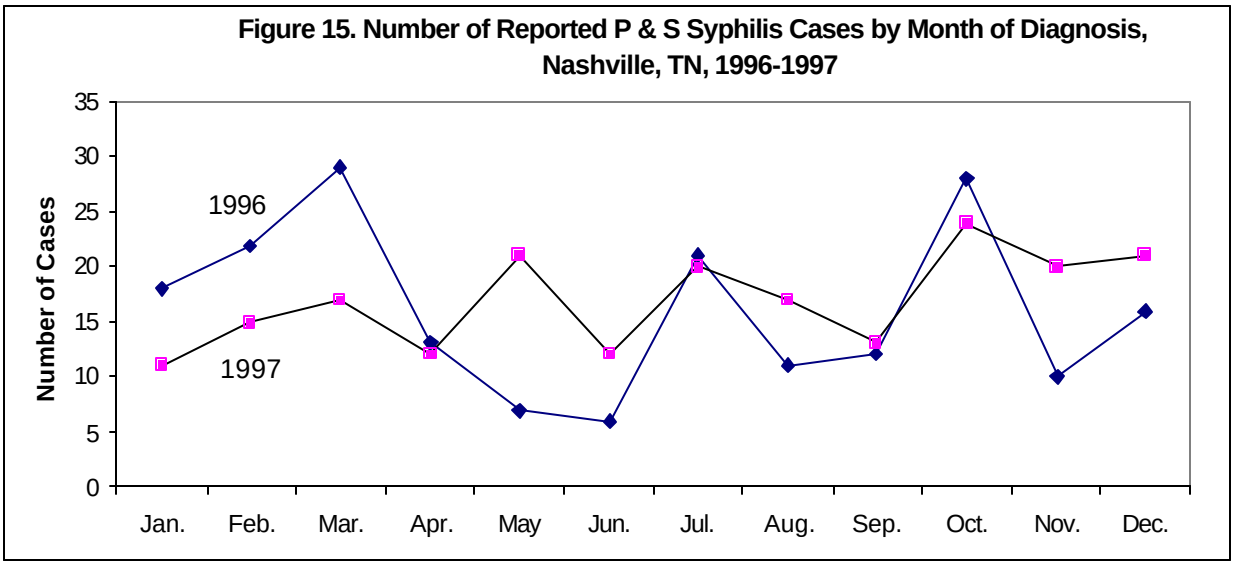
Table 7. Changes of P & S Syphilis Incidence Rates in Two Age Groups, Nashville, TN, 1996 and 1997

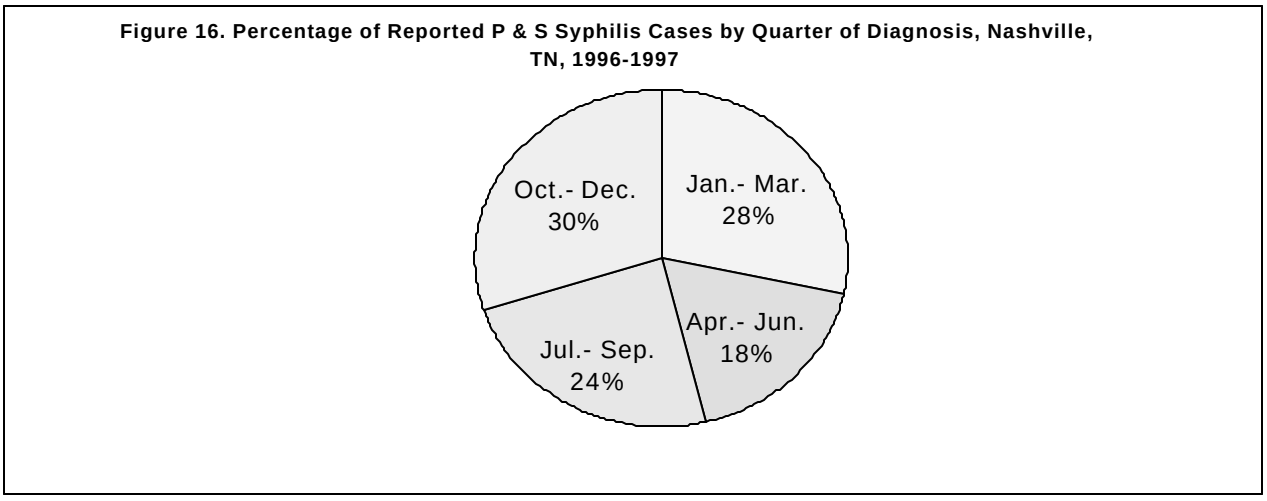
	1996		1997		% of Rate Change
	#	Rate	#	Rate	
Female 15-19: White	0	0	1	9	Infinite
Female 15-19: Black	6	102	16	270	165%
Male 40-49: White	1	3	5	17	467%
Male 40-49: Black	15	208	22	295	42%

c. Time of Diagnosis

Understanding when the disease occurred could provide useful information for disease control and prevention. For this purpose, the date of diagnosis of reported cases was reviewed as the proxy for the time of disease occurrence. It revealed that a relatively higher number of P & S syphilis cases were diagnosed in March, July, and October. While average cases diagnosed per month was 33 during 1996-1997, these three months had 46, 41, and 52 cases respectively. Why these three months had higher numbers of P & S syphilis diagnosed is unknown (Figure 15).

When data were examined by quarters, the fourth quarter (October through December) had the highest number of cases diagnosed, followed by the first quarter (January through March)(Figure 16).





d. Place (Geographic Distribution)

After answering the questions of who were most affected by P & S syphilis during this epidemic and when did the P & S syphilis commonly occur, it was important to know where the incidence rates of P & S syphilis were highest and lowest during the 1996-1997 epidemic. This was achieved by investigating cases and rates at the planning district[5] and the 1990 census tract levels.

[5] For public health planning purposes, Nashville has been divided into sixteen planning districts (PDs). Originally, there were fourteen planning districts. They were geographical subdivisions of the county adopted many years ago by the Metropolitan Planning Commission. Each planning district consists of one to sixteen 1990 census tracts. Due to noticeable changes in demographic factors in planning districts 7 and 10, it was decided in 1998 to divide planning districts 7 and 10 each into two sub-divisions, i.e., PD 7 south (PD7S), PD 7 north (PD7N), PD 10 south (PD10S), and PD 10 north (PD10N). The division was based on 1990 census tract information. (Map 1, Appendix, Page 33)

(1) Planning Districts

Table 8 shows the number and incidence rates of P & S syphilis in Nashville's sixteen planning districts (PDs). Downtown Nashville (PD9) had the highest P & S syphilis incidence rate, while North Nashville (PD8) had the highest number of reported cases. From Map 1 (Page 33), it is apparent that the majority of reported P & S syphilis cases were concentrated in Downtown and its surrounding planning districts. The six PDs with the highest incidence rates in Nashville were all in Downtown and its surrounding area. These six PDs had one-third of Nashville's population (181,380 persons, 34.1%), however, they account for more than four in five reported cases of P & S syphilis (323 cases, 81.6%).

Table 8. Number and Incidence Rate per 100,000 Persons of P & S Syphilis Cases by Planning District, Nashville, TN, 1996-1997

Planning District (PD1: Joelton = Planning District one: community name)	1997 Population Estimate		1996-1997 P & S Syphilis			1996 P & S Syphilis		1997 P & S Syphilis	
	#	%	#	%	Average Rate*	#	Rate**	#	Rate**
PD9: Downtown	3,367	0.6	14	3.5	208.4	6	179.2	8	237.6
PD8: North Nashville	25,015	4.7	99	25.0	198.4	46	184.9	53	211.9
PD10N: West End/Vanderbilt	24,550	4.6	41	10.4	83.7	17	69.6	24	97.8
PD11: Berry Hill/Woodbine	33,222	6.3	55	13.9	83.1	36	109.0	19	57.2
PD3: Bordeaux/Whites Creek	26,829	5.0	36	9.1	67.3	17	63.7	19	70.8
PD5: East Nashville/Inglewood	68,397	12.9	78	19.7	57.2	35	51.5	43	62.9
PD2: Bellshire/Union Hill	16,999	3.2	13	3.3	38.3	6	35.5	7	41.2
PD7N: Nations/Sylvan Park	13,472	2.5	6	1.5	22.3	3	22.4	3	22.3
PD13: Priest Lake/Antioch	45,890	8.6	12	3.0	13.1	5	11.0	7	15.3
PD4: Madison/Goodlettsville	39,369	7.4	10	2.5	12.7	6	15.3	4	10.2
PD1: Joelton	4,880	0.9	1	0.3	10.3	1	20.6	0	0
PD12: Tusculum/Crieve Hall	65,892	12.4	10	2.5	7.6	4	6.1	6	9.1
PD7S: Belle Meade/West Meade	27,223	5.1	4	1	7.4	2	7.4	2	7.3
PD6: Bellevue	28,274	5.3	4	1	7.1	3	10.7	1	3.5
PD14: Donelson/Hermitage	62,956	11.8	4	1	3.2	1	1.6	3	4.8
PD10S: Forest Hills/Oak Hill	45,162	8.5	0	0	0	0	0	0	0
Unknown	N/A	N/A	9	2.3	N/A	5	N/A	4	N/A
Total	531,496	100.0	396	100.0	N/A	193	N/A	203	N/A

* Average rate is average annual incidence rate, calculated by (1996 rate + 1997 rate)/2.
** 1996 and 1997 rates are calculated respectively using 1996, 1997 TDH population projection adjusted to the planning district level.
N/A: Not Applicable.

(2). 1990 Census Tracts

To narrow down the reported P & S syphilis cases geographically, data at the 1990 census tract (CT) level were analyzed (Map 2, Appendix, Page 34). Since the number at the CT level was usually small, we should interpret data cautiously. The intention of this

geographic analysis at the 1990 CT level is to examine the geographic distribution pattern and to find the core distribution areas with clusters of P & S syphilis cases in Nashville[6].

Of all 111 CTs in Nashville, 52 CTs in 1996 and 49 CTs in 1997 did not have reported P & S syphilis cases. Combining 1996 and 1997 data, only 34 CTs did not have reported cases.

Of the 77 CTs that had reported P & S syphilis cases during 1996-97, the number of cases reported in each CT ranges from 1 to 32 cases. On average, there were 5.1 cases per CT. However, cases were distributed unevenly. More than one third (28 CTs, 36.4%) of these 77 CTs had only one reported case during this two-year epidemic time. In terms of incidence, the highest incidence rate in one CT was 604 cases per 100,000 (CT 160.00) and the lowest rate was 3.3 (CT 156.01).

Ranking the CT case counts, 25 CTs were identified with five or more reported cases during 1996-1997. These 25 CTs had a total of 296 cases, accounting for 74.8% of all reported P & S syphilis cases in the two-year period. Ranking the CTs by incidence rate, 25 CTs were identified with an incidence rate greater than 75.5 cases per 100,000 persons during 1996-1997. These 25 CTs had a total of 261 cases, accounting for 65.9% of all cases. Combining these two CT lists, a list of 30 CTs was developed with a total of 309 reported cases, accounting for 78.0% of all reported cases (Map 3, Appendix, Page 35).

Tables 9a and 9b show the top ten CTs ranked by case count and by rates. The top ten CTs ranked by case count (total 11 CTs) had 45.2% (179 cases) of all reported cases while the top ten CTs ranked by rate had 36.1% (143 cases) of all cases.

Table 9a. The Top Ten Census Tracts with High Number of P & S Syphilis, Nashville, TN, 1996-1997

1990 Census Tract	1990 Population	1996-1997 Number of Reported Cases	1996-1997 Average Incidence Rate*
148.00	3678	32	435.0
137.00	5372	28	260.6
162.00	3577	16	223.7
113.00	5400	14	129.7
128.00	9310	14	75.2
139.00	1784	14	392.4
160.00	1159	14	604.0
127.00	7505	13	86.6
144.00	2130	12	281.7
114.00	5584	11	98.5
140.00	2510	11	219.1

* 1996-1997 average incidence rate is average annual rate, calculated by (1996-1997 number of reported cases/2)/1990 population.

[6]Literature suggests that the spread of the STD epidemic is largely attributable to a small group (referred to as the core) of high-frequency transmitters with large numbers of sex partners. Some common characteristics of STD core members may include urban residence, low socioeconomic status, age between 15 and 30, membership in an ethnic or racial minority population. Core areas are socio-geographic distribution of hyper-endemic areas, characterized by poverty and poor health care access (20-22).

Table 9b. The Top Ten Census Tracts with High Rates of P & S Syphilis, Nashville, TN, 1996-1997

1990 Census Tract	1990 Population	1996-1997 Number of Reported Cases	1996-97 Average Incidence Rate*
160.00	1159	14	604.0
148.00	3678	32	435.0
141.00	474	4	422.0
139.00	1784	14	392.4
144.00	2130	12	281.7
149.00	547	3	274.2
137.00	5372	28	260.6
143.00	1930	10	259.1
146.00	2230	10	224.2
162.00	3577	16	223.7

* 1996-1997 average incidence rate is average annual rate, calculated by (1996-1997 number of reported cases/2)/1990 population.

Combining Tables 9a and 9b, we have fifteen census tracts with the highest case count and incidence. Together, these fifteen CTs (Table 9c) had 206 cases, accounting for more than half (52.0%) of all reported cases. Undoubtedly, these areas should be primary target areas for syphilis control and prevention intervention (Map 4, Appendix, Page 36).

Table 9c. Fifteen Census Tracts with 52.0% of P & S Syphilis Cases, Ranked by Rate, Nashville, TN, 1996-1997

1990 Census Tract	1990 Population	1996-1997 Number of Reported Cases	1996-1997 Average Incidence Rate*
160.00	1159	14	604.0
148.00	3678	32	435.0
141.00	474	4	422.0
139.00	1784	14	392.4
144.00	2130	12	281.7
149.00	547	3	274.2
137.00	5372	28	260.6
143.00	1930	10	259.1
146.00	2230	10	224.2
162.00	3577	16	223.7
140.00	2510	11	219.1
113.00	5400	14	129.7
114.00	5584	11	98.5
127.00	7505	13	86.6
128.00	9310	14	75.2

* 1996-1997 average incidence rate is average annual rate, calculated by (1996-1997 number of reported cases/2)/1990 population.

e. Comparison of P & S Syphilis between Pre-epidemic and Epidemic Period

To find out which sub-groups were most affected by this epidemic, the data from the pre-epidemic (1994-1995) and the epidemic (1996-1997) periods were compared.

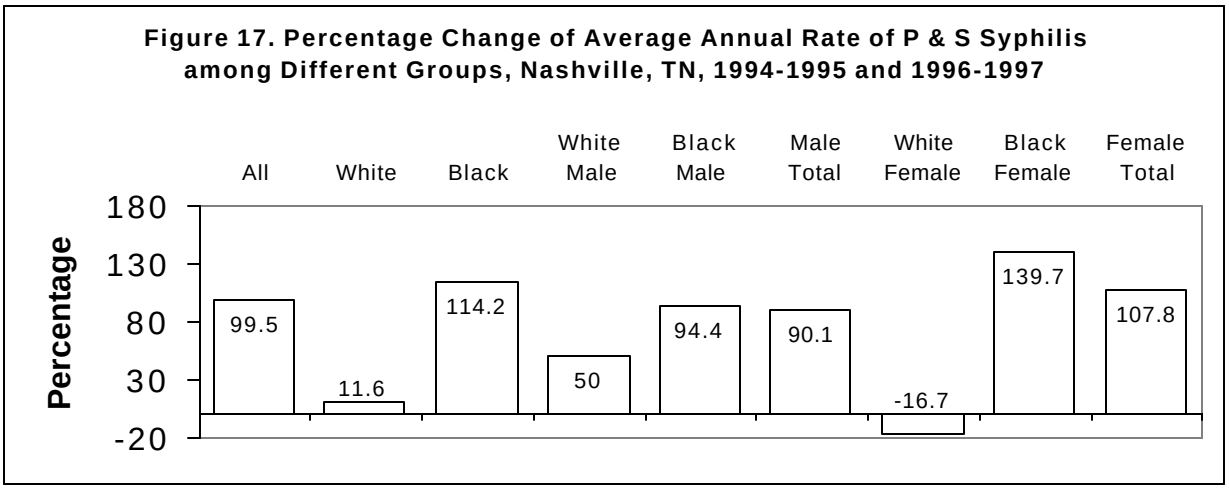
(1) Gender and Race Comparison

From Table 10a and Figure 17, it is apparent that blacks were more often affected than whites, and males were more often affected than females during this epidemic. Among all sub-groups, black females were affected most with approximately 140% increase of P & S syphilis rate. In contrast to black females, white females had approximately 17% decrease of incidence rate during this epidemic.

Table 10a. Percentage Change of Average Annual Rate of P & S Syphilis Among Different Groups, Nashville, TN, 1994-1995 and 1996-1997

	All	White	Black	Male			Female		
				White	Black	Total	White	Black	Total
1994-1995 Rate*	18.7	4.3	63.4	3.8	76.8	21.2	4.8	51.9	16.7
1996-1997 Rate**	37.3	4.8	135.8	5.7	149.3	40.3	4.0	124.4	34.7
% Change	*99.5*	*11.6*	*114.2*	*50.0*	*94.4*	*90.1*	*-16.7*	*139.7*	*107.8*

* 1994-1995 rate is 1994-1995 average annual rate, calculated by (1994 rate + 1995 rate)/2.
** 1996-1997 rate is 1996-1997 average annual rate, calculated by (1996 rate + 1997 rate)/2.



(2) Age Group Comparison

Table 10b shows that all age groups had a remarkable percentage change. Of them, the 15-19 age group had the largest percentage change[7]. The next group was the

[7] Since the 10-14 age group only had one case in 1996-1997 from zero case in 1995-1996, comparison would offer very little information. Therefore, this age group was excluded from age group comparison analysis.

20-29 age group. Although the 30-39 age group had the highest incidence in 1997, the percentage change was not as dramatic as that of the 15-19 age group.

Table 10b. Percentage Change of Average Annual Rate of P & S Syphilis Among Different Age Groups, Nashville, TN, 1994-1995 and 1996-1997

	10-14	15-19	20-29	30-39	40-49	50+
1994-1995 Rate*	0.0	15.5	27.5	48.0	22.5	5.5
1996-1997 Rate**	1.5	45.5	64.5	89.5	41.5	8.5
% Change	*Infinite*	*193.5*	*134.5*	*86.5*	*84.4*	*54.5*

* 1994-1995 rate is 1994-1995 average annual rate, calculated by (1994 rate + 1995 rate)/2.
** 1996-1997 rate is 1996-1997 average annual rate, calculated by (1996 rate + 1997 rate)/2.

(3) Planning District Comparison

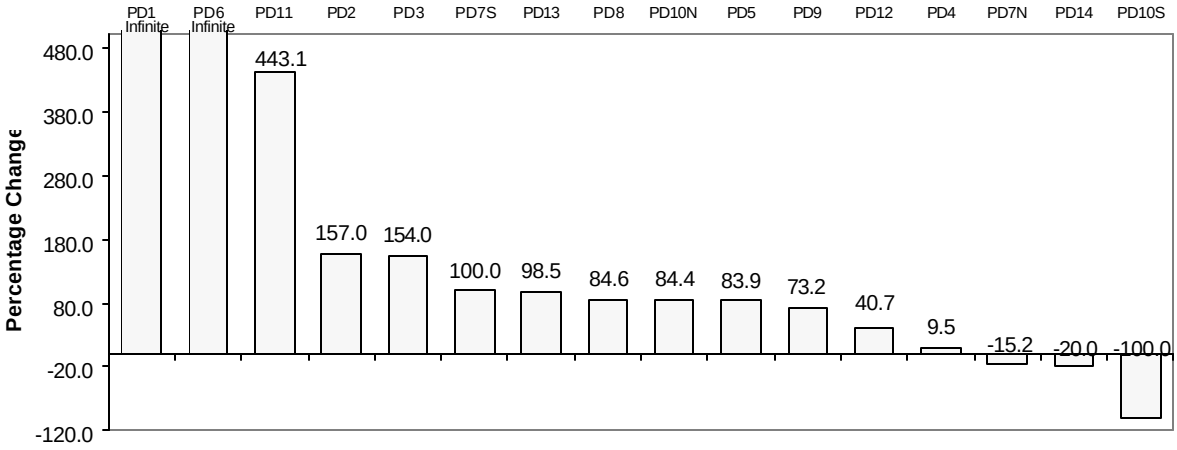
From Table 10c and Figure 18, it was observed that: (1) two areas (Joelton and Bellevue) had experienced their first P & S syphilis cases since 1994; (2) three areas (Berry Hill/Woodbine, Bellshire/Union Hill, and Bordeaux/Whites Creek) had a large increase of incidence from 1994-1995 to 1996-1997; (3) two areas (Belle Meade/West Meade and Priest Lake/Antioch) had a large percentage increase but the incidences were not as high as the Downtown core area; (4) two core areas during the pre-epidemic time (North Nashville and Downtown) had significant increases during the epidemic period; (5) three areas (The Nations/Sylvan Park, Donelson/Hermitage and Forest Hills/Oak Hill) had a decrease of incidence from the pre-epidemic to the epidemic period.

Table 10c. Percentage Change of Average Annual Rate of P & S Syphilis by Planning Districts, Nashville, TN, 1994-1995 and 1996-1997

Planning District	1994-1995 Rate*	1996-1997 Rate**	% Change***
PD1: Joelton	0.0	10.3	Infinite
PD6: Bellevue	0.0	7.1	Infinite
PD11: Berry Hill/Woodbine	15.3	83.1	443.1
PD2: Bellshire/Union Hill	14.9	38.3	157.0
PD3: Bordeaux/Whites Creek	26.5	67.3	154.0
PD7S: Belle Meade/West Meade	3.7	7.4	100.0
PD13: Priest Lake/Antioch	6.6	13.1	98.5
PD8: North Nashville	108.0	198.4	84.6
PD10N: West End/Vanderbilt	45.4	83.7	84.4
PD5: East Nashville/Inglewood	31.1	57.2	83.9
PD9: Downtown	120.0	208.4	73.2
PD12: Tusculum/Crieve Hall	5.4	7.6	40.7
PD4: Madison/Goodlettsville	11.6	12.7	9.5
PD7N: The Nations/Sylvan Park	26.3	22.3	-15.2
PD14: Donelson/Hermitage	4.0	3.2	-20.0
PD10S: Forest Hills/Oak Hill	1.1	0.0	-100.0

* 1994-1995 rate is 1994-1995 average annual rate, calculated by (1994 rate + 1995 rate)/2.
** 1996-1997 rate is 1996-1997 average annual rate, calculated by (1996 rate + 1997 rate)/2.
*** % Change is calculated by (1996-1997 rate-1994-1995 rate)/1994-1995 rate X 100

Figure 18. Percentage Change of Average Annual Rates of P & S Syphilis by Planning District, Nashville, TN, 1994-1995 and 1996-1997



(4) Census Tract Comparison

To examine the geographical distribution dynamic at the census tract level, the reported P & S syphilis cases were mapped by year for 1994-1997. From Maps 5-9 (Appendix, Page 37-41), we observed two disease dynamics. (1) P & S syphilis had been spreading from Downtown and North Nashville areas to suburban Nashville from the pre-epidemic time to the epidemic time. (2) The number of reported cases of P & S syphilis had been increasing in Downtown and North Nashville areas and their close adjacent areas.

Table 10d shows the first disease dynamic by numbers. In 1994 forty-eight CTs reported P & S syphilis cases; in 1995 41 CTs reported the cases; in 1996 the number of CTs reported cases increased to 59; and in 1997, 64 . Comparing the number of CTs that had reported cases during 1994-1995 with that of 1996-1997, a 24.2% increase of number of CTs was observed from the pre-epidemic to the epidemic period. Of all CTs that first experienced reported cases since 1994, census tract 148.00 deserves special attention. Not only did this CT experienced its first case since 1994, it also had the highest absolute number of reported cases among all CTs during the 1996-1997 epidemic period.

Table 10d. Number of Census Tracts with Reported Cases, 1994-1997 and Percentage Change of Census Tracts with Reported Cases, Nashville, TN, 1994-1995 and 1996-1997

Census Tract	1994	1995	1996	1997	1994-1995*	1996-1997*	% Change 1994-1995 and 1996-1997
P & S Syphilis Cases Reported	48	41	59	64	62	77	24.2
No P & S Syphilis Cases Reported	63	70	52	49	49	34	-30.6
CTs with Reported Cases as % of All CTs	43.2	36.9	53.2	57.7	55.0	69.4	

* Each year, reported cases were distributed in different CTs, some CTs had cases in one year but had no case in another year. Therefore, the combined two-year period had more CTs with reported cases than any single year.

Table 10e reflects the second disease dynamic. Fifteen CTs identified in the previous section were examined. In addition to two CTs that had experienced their first reported cases since 1994, the remaining 13 CTs had a large increase of incidence rate, ranging from 42.8% increase to 1298.1% increase. On average, each of these 13 CTs had a 300.2 % increase. Of these 13 CTs, two had a remarkable increase (more than 600%). They were CTs 160.00 and 162.00 (Figure 19). From Map 4 (Appendix, Page 36), it is noted that all of 15 CTs were in Downtown and its close adjacent areas, 5 of these 15 CTs were in North Nashville planning district area (75 cases), 3 of them were in Berry Hill/Woodbine planning district area (49 cases).

Figure 19. Percentage Change of Average Annual Rate of P & S Syphilis among 15 Census Tracts, Nashville, TN, 1994-1995 and 1996-1997

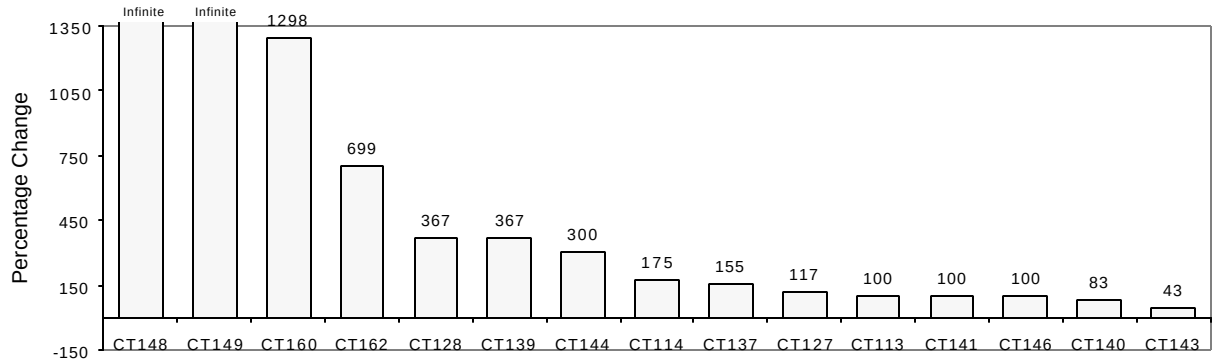


Table 10e. Percentage Change of Average Annual Rate of P & S Syphilis among 15 Census Tracts, Nashville, TN, 1995-1996 and 1996-1997

Planning District	Census Tract	1994-1995 Rate*	1996-1997 Rate**	% Change
PD11: Berry Hill/Woodbine	148.00	0.0	435.0	Infinite
PD11: Berry Hill/Woodbine	149.00	0.0	274.2	Infinite
PD11: Berry Hill/Woodbine	160.00	43.2	604.0	1298.1
PD10N: West End/Vanderbilt	162.00	28.0	223.7	698.9
PD3: Bordeaux/Whites Creek	128.00	16.1	75.2	367.1
PD8: North Nashville	139.00	84.1	392.4	366.6
PD8: North Nashville	144.00	70.4	281.7	300.1
PD5: East Nashville/Inglewood	114.00	35.8	98.5	175.1
PD8: North Nashville	137.00	102.4	260.6	154.5
PD3: Bordeaux/Whites Creek	127.00	40.0	86.6	116.5
PD5: East Nashville/Inglewood	113.00	64.8	129.7	100.2
PD9: Downtown	141.00	211.0	422.0	100.0
PD9: Downtown	146.00	112.1	224.2	100.0
PD8: North Nashville	140.00	119.5	219.1	83.3
PD8: North Nashville	143.00	181.4	259.1	42.8

* 1994-1995 rate is 1994-1995 average annual rate, calculated by (1994 rate + 1995 rate)/2.
** 1996-1997 rate is 1996-1997 average annual rate, calculated by (1996 rate + 1997 rate)/2.

Since CTs 148.00 and 137.00 had the highest number of reported cases during the 1996-1997 epidemic time, a close examination of cases in these two CTs might provide useful information. As shown in Table 11, there were 32 reported cases in CT 148.00 and 28 cases in CT 137.00. Of the 32 cases in CT 148.00, 93.8% were blacks and 6.3% were whites. Males comprised 25.0% of cases in CT 148.00 while females comprised 75.0% of cases. Among age groups, the 30-39 age group had the majority of cases (56.3%). A different composition was observed in CT 137.00. All of the 28 reported cases in CT 137.00 were blacks. Males comprise 53.6% of cases while females comprise 46.4% of cases. Among age groups, the 30-39 age group had the most of cases (42.9%).

Table 11. Number of P & S Syphilis Cases by Gender, Race, and Age Group, Census Tracts 137.00 and 148.00, Nashville, TN, 1994-1997

	Census Tract 137.00			Census Tract 148.00		
	1994-1995	1996-1997	% of 1996-1997 Number	1994-1995	1996-1997	% of 1996-1997 Number
Gender						
Total	11	28		0	32	
Male	8	15	53.6	0	8	25.0
Female	3	13	46.4	0	24	75.0
Race						
Black	10	28	100.0	0	30	93.8
White	1	0	0.0	0	2	6.3
Gender and Race						
Black Female	3	13	46.4	0	22	68.8
White Female	0	0	0.0	0	2	6.3
Black Male	7	15	53.6	0	8	25.0
White Male	1	0	0.0	0	0	0.0
Age group						
15-19	0	2	7.1	0	1	3.1
20-29	4	11	39.3	0	12	37.5
30-39	3	12	42.9	0	18	56.3
40-49	3	2	7.1	0	1	3.1
50+	1	1	3.6	0	0	0.0

IV. Discussion

The investigation reviewed the distribution and trends of syphilis in Nashville. This review is based on syphilis surveillance data. For syphilis, as well as other STDs, differential reporting of cases from public and private sectors may magnify the differences in reported rates by race (7). In addition, small numbers in some specific subgroups due to stratification may introduce random variation in incidence rates. However, effort has been made in this report to provide as accurate as possible information on syphilis distribution and trends in Nashville.

Analysis of long-term trends suggests that syphilis has been continuously a significant public health problem in Nashville. Of the twenty-two years examined, only seven years of Nashville's P & S syphilis rates were below the nation's rates. These seven years were in the 1970s and the 1980s. The situation of syphilis in Nashville has not improved and became worse in the 1990s.

Research of current trends revealed that both reported cases and incidence of P & S syphilis in Nashville increased during 1988-1997. Specifically, a sharp increase of incidence rates began in 1988, reaching its peak in 1990. Followed by a steady decline for five years, it then increased again in 1996 and continued in 1997. Males and blacks were disproportionately affected by syphilis. While the gap between males and females was narrowing, the gap between whites and blacks was widening. Although the average age of reported cases was increasing, the 20-29 age group was still the most affected sub-group among all age groups. Also noted is the increase in age range of reported cases, suggesting that traditional target age groups (20-29, 30-39) were expanding.

Examination of the 1996-1997 syphilis epidemic in Nashville brought to light a different epidemiological profile of P & S syphilis during this epidemic time, as compared with the pre-epidemic time (1994-1995) and with the last ten-year trend (1988-1997). Six features have been observed from this examination.

1) In terms of gender distribution, male and females were almost equally affected in the 1996-1997 epidemic (males 51%, females 49%) while the ten-year trend shows females were less affected than males (males 55%, females 45%).

2) Racial distribution in the 1996-1997 epidemic demonstrated a wider racial gap. Blacks comprised 90.4% of all reported cases while whites comprised 9.3% of cases (ten-year trend: blacks 87%, whites 13%).

3) In terms of age distribution, the age of reported cases increased noticeably.

   a) The average age of the cases in the 1996-1997 epidemic was older than that during the ten-year period (1988-1997) (33 years versus 31.8 years).

   b) The age range increased. The age difference between oldest cases and youngest cases was 58.5 years during this epidemic while the ten-year trend shows an average age difference of 52.2 years.

c) The 30-39 age group had both the highest number of cases and highest incidence rate in this epidemic while the ten-year trend documented the 20-29 age group as being the most affected age group in both number and incidence rate.

4) Looking at the time of diagnosis, a relatively higher number of cases was diagnosed in March, July, and October during 1996-1997 period.

5) The places with the highest P & S syphilis incidence rate were the planning districts 8 and 9, i.e., North Nashville and Downtown. At the census tract level, fifteen census tracts in Downtown and its adjacent areas were identified as hyper-endemic areas.

6) Compared with the pre-epidemic time, the two groups with the largest increase of rate were black females and the 15-19 age group. Although Joelton, Bellevue, and Berry Hill/Woodbine were the three planning districts with the largest percentage increase, Downtown and North Nashville were still the core areas. The five census tracts with a substantial increase of rate were CTs 148.00, 149.00, 160.00, 162.00, and 128.00.

Literature has suggested that the distribution and trends of syphilis are influenced by many factors. These factors include: 1) biologic factors (e.g., characteristics intrinsic to the *Treponema pallidum* and host responses to infection); 2) sexual behaviors; 3) biomedical factors (e.g., availability of diagnostic tests and effective treatment); 4) availability of and access to health care; 5) health care seeking behaviors; 6) public health efforts to prevent and control syphilis (e.g., screening programs, case findings, and partner notification activities); 7) population factors (e.g., urbanization, poverty, gender ratios); and 8) socio-cultural factors (e.g., disintegration of family, stigmatization of those with the disease, patterns of illicit drug use) (1,19).

With a new pattern of syphilis distribution in the 1996-1997 epidemic in Nashville, it is important to examine the above mentioned factors for the prevention and control of syphilis in this community.

Biologic factors: Age and gender may influence the risk of acquiring or transmitting syphilis. Young women and female adolescents are more susceptible to syphilis and other STDs compared to their male counterparts because of the biological characteristics of their anatomy. The primary stage of syphilis is often silent in women. Other biologic factors include long incubation time, presence of male penile foreskin, and immunity resulting from prior sexually transmitted or related infections (1). Biologic factors will not change overnight, therefore, it cannot explain the sudden rise of P & S syphilis in 1996 and 1997.

Sexual behavior: Sexual behaviors that place individuals at greater risk of exposure to syphilis include initiation of sexual intercourse at an early age, greater number of partners, high-risk partners, increased frequency of intercourse and certain sexual practices, and lack of barrier contraceptive use (1). Preliminary analysis indicates some reported cases in this epidemic were younger than that of the pre-epidemic period. A significant increase of rate in the female 15-19 age group, coupled with a big increase in the male 40-49 age group during the 1996-1997 epidemic, may indicate some changes in sexual behavior patterns. This change may be associated with this epidemic.

Literature has suggested that since the 1980s, the available pool of low-risk heterosexual male partners has declined disproportionately in some groups. Thus, women in those groups have a higher risk of infection. Declines in long-term monogamous relationships may also have occurred and resulted in an increased risk of infection (19). As part of the investigation, collection and analysis of risk factors data regarding reported cases is in progress. More information regarding the association of change of sexual behaviors and the 1996-1997 syphilis epidemic will be reported in part two of this investigative report.

Biomedical factors: Syphilis diagnosis tests are available. The efficacy of penicillin for syphilis treatment is well established (23). Although resistant to antibiotics is widespread among gonorrhea cases (22), there have been no syphilis drug resistance cases reported recently. Therefore, biomedical factors are unlikely the explanation for this epidemic.

Availability of and access to health care: With the implementation of TennCare in 1994, health care access increased significantly for those who were previously uninsured or uninsurable. The increased access to health care may allow more syphilis patients to be diagnosed and treated. These patients may otherwise go undiagnosed or treated. On the other hand, TennCare may have led to decreasing use of the free STD Clinic at the Metropolitan Health Department of Nashville and Davidson County (MHD) and an increase of using health providers in the private sectors (24). The impact of this change is unknown.

One study documented that nine states and cities reported problems with syphilis care provided in the private sector, including repeated errors in diagnosis and classification of patients and failure to treat diagnosed patients (25). Plus, the gender, race, and culture of most providers is different from that of their clients. Literature has provided much evidence that history taking and preventive counseling are substantially more effective when the provider and client are of the same race-culture and gender (25). This had a negative impact not only on the effectiveness of syphilis care but also on syphilis patients' health care seeking behaviors. Further studies are needed to assess the impact of TennCare to the availability of and access to the syphilis care in our community.

Health care seeking behaviors: Health care seeking behaviors are influenced directly and indirectly by the availability of and access to health care. The introduction of TennCare has dramatically changed the health care delivery system in this community. These changes may have influenced certain sub-population's health care seeking behavior. Whether the impact was positive or negative to the syphilis care is unknown. Again, studies are needed to test the hypothesis.

Public health efforts to prevent and control syphilis: Documented by one recent study, median ratios of public STD providers per patient with infectious syphilis appear far lower in the southern states than in the comparison non-southern states (Between 1963 and 1993, the South had higher rates of P & S Syphilis than any other region). The ratios of public STD providers per patient may be too low to allow prompt service and effective behavioral counseling to these relatively difficult patients (19, 25). To determine if this observation is applicable to this community, more data are required.

Population factors: Nashville is part of a national trend for metropolitan areas to develop in a shape resembling a "doughnut." Growth in Nashville's surrounding, or

"doughnut" counties is increasing while the "core", Davidson County, is growing slowly (26). Nashville Metropolitan Statistical Area[8] (MSA) is the second fastest growing MSA in Tennessee with 15.2% growth during 1990-1997, making it the largest MSA in the state (28). In 1996, Nashville was comprised of roughly 47% male and 53% female. The population was slightly younger than that of Tennessee as a whole; 60.7% was under age 40. Davidson County is more racially diverse than the state as a whole, with 73% white, 25% black, and 2% other races (29).

The above facts suggest Nashville is becoming more urbanized. Urbanization of Nashville is not without side effects. According to the Tennessee State Data Center, as of 1993, 17.9% of Davidson County residents are living in poverty. Even higher is the percentage of school-aged children living in poverty in Davidson County, 27.3% (28). Along with a relatively higher proportion of poverty, crime in Nashville demonstrated an increasing trend. In 1996, Nashville's rank in crime, with 24 comparable cities, was 7th highest from 27th highest in 1985 (30). Poverty is also associated with teenage pregnancy. In 1996, teenage pregnancies (10-19 years old) in Davidson County was 16% of all pregnancies, 4.2% increase from 1995 (31).

All of these population factors could have been contributing factors to the syphilis epidemic: 1) The high percentage of poverty in the population and the increasing trend in crime may have played a role in the syphilis increase. Studies show that specific sex and drug use behaviors have been identified as associated with acquisition of syphilis in the most recent syphilis epidemics (32). 2) A relatively higher percentage of the female population (53% in Nashville, 51% in the United States) may have been associated with a low availability of the pool of low risk heterosexual male partners and a relatively higher vulnerable population (young women and female adolescents are more easily infected than men). This, coupled with other factors, may partially be related to the decline of male-to-female rate ratio, an indicator of a disproportionate increase in the rate of syphilis among women. 3) Fast growth of the MSA population may introduce some high risk group members from outside of Davidson County. The MHD STD program staff observed an increasing number of syphilis contacts from Nashville's surrounding counties (33). This may bring new sources to Nashville's syphilis reservoir.

Socio-cultural factors: It was observed by MHD STD program staff that there were core areas and core groups for syphilis in Nashville. The core area hypothesis is supported by data presented in this report. Literature documented that the activities of core group members sustain hyper-endemic levels of syphilis within the core. Because the core is not a closed population, its members are also responsible for infection outside the core. The mixing of core and non-core members facilitates transmission of syphilis to the wider pool of

[8] Metropolitan Statistical Area (MSA) is a core area containing a large population nucleus, together with adjacent communities having a high degree of economic and social integration with that core. Standard definition of metropolitan areas were first issued in 1949 by the then Bureau of the Budget (now, the United States Office of Management and Budget), under the designation "standard metropolitan area" (SMA). The term was changed to "standard metropolitan statistical area" (SMSA) in 1959, and to "metropolitan statistical area" (MSA) in 1983. The current standards provide that each newly qualifying MSA must include at least one city with 50,000 or more inhabitants, or a Census Bureau-defined urbanized area (of at least 50,000 inhabitants) and a total metropolitan population of at least 100,000 (75,000 in New England). (27)

partners in the general population. Many core members were involved in sex for drugs or money (22).

Historically, the drug culture in the Nashville area is not limited to people living in poverty, but the cost of the drug habit is high enough that poor persons who are addicted have limited means of acquiring drugs. A crack addict's first priority is to continue taking the drug and among the poor this is often accomplished through prostitution and drug sales. MHD STD program staff have observed that drug use among their clientele is notable. A rapidly increasing proportion of the contacts of the syphilis cases are crack cocaine addicts. These individuals are difficult to find and when found, are resistant to going to a clinic or physician for treatment. Consequently, crack addicts in Nashville are likely to remain in the community and have more contacts for longer periods than non-drug users (34).

Furthermore, although prostitution has long been a primary means of supporting drug habits among women, the combined pharmacological effects of drugs on sexuality as well as socio-cultural factors, have made the exchange of sex for drugs a principle feature of drug phenomenon (35). Cocaine-using prostitutes are less likely to provide identifying information about their sexual partners than others who have syphilis. There is no way to locate these anonymous sex partners. Thus, because the chain of transmission becomes more difficult to follow, control becomes more difficult, more expensive, and less effective. It was hypothesized that sex for drugs and money were the critical factors for the current epidemic. A correlational study and a case-control study have been planned to test this hypothesis. The result of the studies will be presented in part two of this report at a later date.

In summary, syphilis has been a chronic public health problem in Nashville. The problem became worse in the 1990s. With two syphilis epidemics in the 1990s: one being in 1990, another being current, new ways need to be found to prevent and control syphilis in this community. An effective system of syphilis prevention and control will have to be developed at the community levels, with full participation of both public and private sectors. All members of the community must do their part. Bold community leadership from the highest levels is needed. A successful Nashville initiative to control the syphilis epidemic requires widespread public awareness and participation.

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APPENDIX

TABLE OF MAPS